Novel Cu_6Sn_5 thin film electrodes for high performance thin film batteries

Scientific Achievement

Due to the instability of lithium metal anode used for lithium ion rechargeable thin film batteries (TFB), it is very important to develop alternative anodes with high stability as well as good performance.

- Novel Cu_6Sn_5 film anode has been synthesized using magnetron RF sputtering and investigated for its electrochemical performance.
- We have studied of Cu_6Sn_5 composites prepared using highly electrical conductive under-layers of Ni, Cu and Pt and the study revealed that the composite between Cu_6Sn_5 and Pt shows improved capacity of ~2900mAh/cc, which is about 3.5 times higher than the capacity of carbon anode in commercial lithium ion rechargeable batteries.
- In order to understand this behavior deeper, intensive micro-structural analyses are scheduled for the next step, which will lead to the development of composites with optimized combination of elements and compositions.
- We also have been working on the development of other components i.e. cathode and electrolyte for thin film batteries. Thin film cathodes and electrolyte materials are also sputter deposited respectively for electrochemical performances and optimization for the use in thin film batteries. The effort to combine all these components integrated in a single substrate for full functioning thin film batteries is in progress.

Significance

Thin film batteries (TFB) are essential to meet increasing demand for power sources that can be incorporated into a variety of devices such as implantable medical devices, electronic parts with surface mounted or embedded batteries, remote sensors, and smart cards, etc. The opportunity to develop a new class of micro-batteries for bio-implantable devices, etc, makes this project an important first step in opening up new markets for lithium–ion batteries in the US.

Recently, the result of the work was submitted to *Journal of Electrochemical Society* and to be published. In addition, this work was presented at electrochemical society annual meeting (2005) and materials research society meeting (2005).

Performers

I. Kim, O. Auciello, J. A. Carlisle and M. J. Pellin (ANL-MSD)

J. T. Vaughey (ANL-CMT)

J. Elam (ANL-ES)

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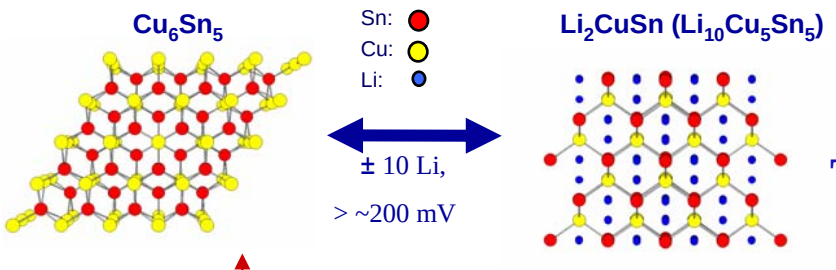
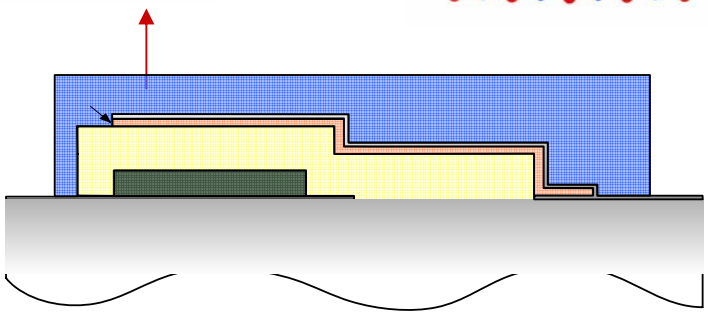
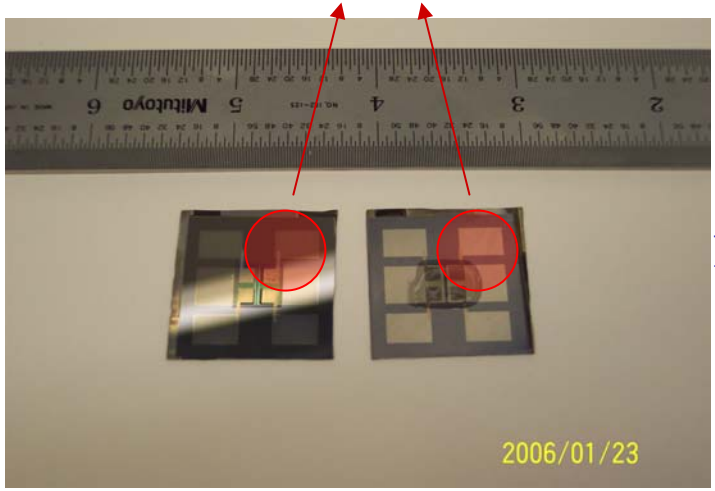


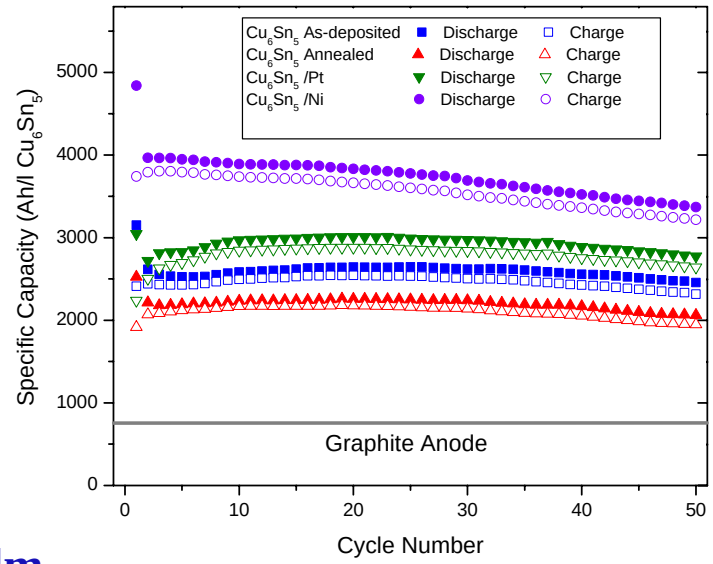
Structural Transformation



Cross-sectional structure



Prototype thin film batteries for test



Cycling performance of Cu_6Sn_5 anode(s).

IL-Seok Kim
O. Auciello
J.A. Carlisle
J. Elam
M.J. Pellin

Materials Science Division
ARGONNE NATIONAL LABORATORY

J.T. Vaughey (ANL-CMT)